# Functional Requirement

2. Functional Requirements (Total 23 Items)  
2.1 Data Collection  
Input: Real-time data from probe vehicles, traffic sensors, weather stations, and traveler information systems.  
Output: Raw data stored in Oracle 10G database.  
Description: The system must receive, validate, and store incoming data from various external sources.  
2.2 Data Quality Check  
Input: Raw data records.  
Output: Validated or rejected data entries.  
Description: The system must perform automated checks on data integrity, format, and plausibility.  
2.3 Traffic Metrics Calculation  
Input: Validated traffic data.  
Output: Congestion levels, travel times, queue lengths.  
Description: The system must calculate key traffic performance indicators using predefined algorithms.  
2.4 Incident Detection and Classification  
Input: Anomalies in traffic flow or sensor data.  
Output: Incident reports with type, location, severity, and time.  
Description: The system must detect potential incidents and classify them based on predefined rules.  
2.5 Road Surface and Weather Condition Inference  
Input: Weather station data and environmental sensor readings.  
Output: Road surface state (e.g., icy, dry), temperature, precipitation.  
Description: The system must infer current road and weather conditions using environmental data.  
2.6 Dynamic Data Caching  
Input: Processed data.  
Output: Cached data accessible within minutes.  
Description: The system must maintain a dynamic cache of recent data for quick access by internal and external applications.  
2.7 Long-Term Archiving  
Input: Historical data.  
Output: Archived data stored for future analysis.  
Description: The system must archive all processed data in Oracle 10G for retrieval and historical analysis.  
2.8 Data Publication  
Input: Processed data.  
Output: Published data in TMDD and SAE J2354 formats.  
Description: The system must generate standardized output files and publish them to designated endpoints.  
2.9 Alert Generation  
Input: Incident or weather event data.  
Output: Alerts sent via email, SMS, or API.  
Description: The system must generate and deliver alerts based on thresholds and user-defined rules.  
2.10 MI Drive Presentation Support  
Input: Processed data.  
Output: Data formatted for MI Drive visualization tools.  
Description: The system must provide compatible outputs for use with MDOT's MI Drive system.  
2.11 Web-Based User Interface  
Input: User queries and selections.  
Output: Map display, incident icons, and data overlays.  
Description: The system must provide a web-based UI with map-based views, icon layers, and de-cluttering capabilities.  
2.12 Extensibility and Configuration  
Input: New data source definitions or algorithm configurations.  
Output: Updated processing pipelines or outputs.  
Description: The system must allow for configuration of new data sources, algorithms, and output formats without code changes.  
2.13 User Access Control  
Input: User identity and role definition.  
Output: Controlled access permissions.  
Description: The system must implement Role-Based Access Control (RBAC) to ensure users only access authorized data and functions.  
2.14 Historical Data Query  
Input: Time range, location, and data type.  
Output: Historical data records matching criteria.  
Description: The system must allow users to query past traffic, weather, and event data with visualization or export options.  
2.15 Automated Report Generation  
Input: Report template, time range, geographic area.  
Output: PDF or HTML report containing key metrics.  
Description: The system must support generating daily, weekly, or monthly reports with statistics like average speed, congestion index, and incident counts.  
2.16 Multi-Language Support  
Input: Selected language (default: English).  
Output: Localized interface and message display.  
Description: The system must support multiple languages (e.g., English, Spanish) to serve diverse user groups.  
2.17 Mobile-Friendly Interface  
Input: Mobile device access request.  
Output: Responsive web interface optimized for mobile devices.  
Description: The system must be designed to work seamlessly on smartphones and tablets, including map browsing and alert notifications.  
2.18 Third-Party API Integration  
Input: External service APIs (e.g., Google Maps, Waze, Twitter).  
Output: Integrated data stream or interactive features.  
Description: The system must support integration with third-party APIs to enhance data collection and public feedback mechanisms.  
2.19 Real-Time Dashboard  
Input: Selected monitoring object (e.g., a highway, city).  
Output: Dynamically updated charts and metrics.  
Description: The system must provide a customizable real-time dashboard showing traffic flow, weather trends, and event frequencies.  
2.20 Data Sharing and Collaboration  
Input: Shared links or reports created by users.  
Output: Accessible shared content (with permission control).  
Description: The system must allow users to share specific map views, reports, or alerts with others internally or externally.  
2.21 Disaster Recovery Mechanism  
Input: System failure or disruption signal.  
Output: Automatic failover to backup node and service restoration.  
Description: The system must have high availability and disaster recovery capabilities to ensure continuous operation during outages.  
2.22 Custom Algorithm Module  
Input: User-submitted scripts or rule files.  
Output: Results from custom processing logic.  
Description: The system must support user-uploaded algorithms for specialized traffic data analysis, such as predicting peak traffic patterns.  
2.23 Event Lifecycle Management  
Input: Event creation, modification, or closure requests.  
Output: Updated event status and audit logs.  
Description: The system must track the full lifecycle of each event (detection to resolution), including assignments, progress, and completion logs.